

## **CLAIMS**

- 1) Apparatus for fixing, without welding, the tail end of the wrapping of palletized loads, formed using stretch film and/or other elastic and/or plastic material, in particular for rotating-arm or rotating-load wrapping machines, characterized in that it
- 5 comprises:
- a straight counter-rod (4) which during the final stage of the wrapping cycle is raised, arranged vertically and brought up alongside the bottom part of the load, at the correct distance from the latter, so as to ensure that at least the last turn of the wrapping rests on this rod so as to create in the side and bottom part of the said
  - 10 wrapping a pocket (S) of suitable amplitude which is open both upwards and downwards and inside which a portion of the said last turn is sufficiently spaced from the load;
  - means for stopping the wrapping machine when the tail end of the wrapping, which is wholly or partly overlapped by the turn forming the pocket, is at a small distance or
  - 15 touches the said pocket (S) with the associated internal forming rod (4);
  - means (21, 24) for transversely compressing into a bundle at least one section of the tail end of the wrapping, and a secondary gripper (321) and a primary gripper (22) for retaining successive portions of the said bundle of film, these grippers being situated at a small distance from each other and the secondary gripper being closer
  - 20 to the wrapped load;
  - means (23) for cutting the section of film along the section comprised between the said two grippers (321, 22) so as to define the tail end of the wrapping (X) which is retained by the secondary gripper (321) and the front end (Y) of the future wrapping which is retained by the main gripper (22);
  - 25 - means for inserting the secondary gripper (321) with the tail end of the wrapping into the said pocket (S), with insertion from the top part of the said pocket, and means being envisaged for opening this gripper and for extracting it from the pocket and bringing it back into the rest position;
  - means which in synchronism with the means according to the previous point extract
  - 30 from the bottom part of the pocket the rod (4) which formed it, bringing this rod into

the rest position such that, owing to the elastic memory effect of the wrapping film, the pocket is closed and eliminated, becoming a compressed part of the wrapping and retaining inside it the tail end of the said wrapping.

2) Apparatus according to Claim 1, in which a base frame (1) is provided laterally with respect to the wrapping station of the wrapping machine and laterally with respect to the travel path of the loads to be wrapped, the said base frame in rotating-arm wrapping machines supporting all the components of the said apparatus in question and in rotating-load wrapping machines supporting all the components of this apparatus, with the exception of the counter-rod (4) for forming the pocket (S) in the wrapping, which is mounted on the periphery of the carousel which rotates the load, the location of the said frame being such that the components of the apparatus, in their rest position, do not interfere with the load to be wrapped and with the bottom turns of the wrapping of the said load.

3) Apparatus according to Claim 1, in which the counter-rod (4) which determines the formation of the pocket (S) in the bottom part of the wrapping usually has a round cross section, has a length which is proportional to the height of the last turn of the wrapping film and with its bottom end is hinged on a horizontal shaft (3) rotatably supported by a support (2) mounted on the base frame (1) with the possibility of adjusting the orientation about a vertical axis (102), so as to ensure that, during installation of the apparatus, the said rod (4), when it is in the horizontal rest position, is directed towards the load and forms with the latter an acute angle having an amplitude such as to limit the interference of the said rod with the pocket (S) when the said rod is brought from the active position into the rest position, the said pivoting shaft (3) of the rod (4) being connected via a lever (6) to a pivoting actuator (5) which brings the said rod from the horizontal, lowered, rest position into the vertical, raised, working position and vice versa.

4) Apparatus according to Claim 3, in which the free end of the rod (4) for forming the pocket (S) in the wrapping has mounted thereon a roller (104) freely rotatable about an axis substantially coinciding with the longitudinal axis of the said rod, this

roller being provided in order to facilitate disengagement of the rod from the pocket during the last stages of the working cycle of the apparatus.

5) Apparatus according to Claim 4, in which the roller (104) of the counter-rod (4) has rounded edges.

5 6) Apparatus according to Claim 5, in which the roller (104) of the counter-rod (4) has the top end rounded in the form of an ogive and has a cap shape so as to circumscribe rotationally an upper section of the said rod.

7) Apparatus according to Claim 3, in which special damping and end-of-travel means are envisaged for controlling and limiting the displacement of the counter-rod  
10 (4) and/or the associated movement means (5, 6).

8) Apparatus according to Claim 1, characterized in that a primary plate (7) is provided laterally with respect to the counter-rod (4), in a position such as to be located on the outside of the pocket (S) formed in the wrapping of the said rod, said plate with its end being pivotably mounted on a horizontal shaft (8) perpendicular to  
15 the load during wrapping and rotatably supported by support brackets (9) fixed to the base (1) of the apparatus and having fixed at one end a right-angled lever (10) hinged with the stem of an alternating movement actuator (11) mounted on the said base, all of which so that, by means of this actuator (11), the said primary plate (7) can be brought from the vertical rest position with a downwards orientation, into the  
20 horizontal active position, there being mounted on this plate with a secondary plate (14) arranged in between the means (221) for bundling together the tail end of the wrapping and at least the secondary gripper (321) which retains the said tail end of the wrapping so that, depending on the vertical or horizontal positioning of the said plate, these means are respectively in the lowered rest position or in the raised  
25 working position.

9) Apparatus according to Claim 8, in which special damping and end-of-travel means are envisaged for stopping correctly the pivoting plate (7) in the vertical rest position or in the horizontal working position.

10) Apparatus according to Claim 8, in which the said primary pivoting plate (7)  
30 has mounted thereon, parallel thereto and rotatable about an axis (13) perpendicular

to this plate, a secondary plate (14) on which the means (221) for bundling together the tail end of the wrapping and at least the secondary gripper (321) which retains the said tail end of the wrapping are mounted, the said secondary plate being provided for example laterally with an appended part (114) connected to an actuator for performing an alternating rectilinear movement (15), mounted on an arm (107) of the said primary plate (7), all of which so that the operating means mounted on the secondary plate may, upon actuation, be made to rotate for example through ninety degrees or by a suitable amount about their longitudinal axis or about a parallel axis, so as to pass from the rest position where they are located in an ideal vertical plane parallel to the load into an active position where they are located in a substantially vertical ideal plane perpendicular to the said load.

11) Apparatus according to Claim 10, in which special damping and end-of-travel means are envisaged for correctly stopping the secondary plate (14) in the two different positions angularly spaced from each other at ninety degrees.

12) Apparatus according to Claim 10, in which the rotation of the secondary plate (14) about its perpendicular axis (13) may be performed using means other than the lever arm with the associated pivoting actuator, for example using a rack-and-pinion assembly (113) with associated fluid pressure cylinder (15') for alternately actuating the said rack, these means being located underneath the primary plate (7) so as to form a substantial counterweight for the operating means mounted on the said secondary plate (14), with advantages of the dynamic type, also because these means are characterized by a plan volume having a small projection relative to the pivoting fulcrum (8) of the said primary plate (7).

13) Apparatus according to Claim 10, characterized in that the secondary plate (14) has, fixed perpendicularly thereon, at least one straight guide (17), for example of the tubular type, with a polygonal cross section and height slightly greater than the height of the turns forming the pocket (S) in the wrapping of the load, inside which a rod-shaped and adjustable slide (19) telescopically slides with the aid of means (18) having a low coefficient of friction, the said slide being able to be extended or retracted by means of a rectilinear actuator (20) fixed also, via its body, onto the

secondary plate (14) and acting on an upper part of the said slide which rigidly carries an arm (119) in the form of an overturned "L" which has a section parallel to and alongside the said slide (19) and on the bottom end of which an operating unit (21) for bundling together the tail end of the wrapping film is mounted.

5 14) Apparatus according to Claim 13, in which the said operating unit (21) comprises a body (121) which is fixed on the bottom end of the arm (119) with the possibility of being mounted in the correct position with rotation about the longitudinal axis of the said arm and of being able to be locked in the most suitable position, the said body being designed to support the ends of a pair of fork members (221) which  
10 are made for example from a round metal bar and which project from the bottom part of the said body, which diverge downwards and which are identical and parallel to each other, the said body (121) being designed to carry, hinged at the bottom, between the said pair of fork members (221), the pair of jaws (321) of a secondary gripper which are actuated with a self-centring movement by an actuator which is  
15 housed in the said body (121), it being envisaged that, when the jaws (321) are in the open position, their active and preferably toothed surface is raised with respect to the overturned V part of the said fork members (221), whereas, when they are closed, the said jaws project from this V-shaped part and are arranged in the middle of the latter, so as to grip the bundle of the tail end of the wrapping gathered in this same V-  
20 shaped part of the fork members (221).

15) Apparatus according to Claim 14, characterized in that it comprises means for ensuring that, when the said apparatus is in the horizontal rest position, the hook-shaped telescopic assembly (17, 19, 119) which carries the unit (21) with the bundling fork members and the secondary gripper lies in an ideal vertical plane and  
25 is in the contracted position, there being provided means for ensuring that, once the pocket (S) has been formed in the wrapping, the wrapping machine stops with the arm carrying the reel (Z) in a predetermined and constant angular position, with the tail end of the wrapping which is situated at a short distance from the counter-rod (4) which forms the said pocket (S) and which for this reason is located in a correct  
30 position for gripping by the said unit (21), means being envisaged so that in

synchronized sequence the said telescopic assembly (17, 19, 119) is raised into a vertical position and is simultaneously extended so that, at the end of the raising stroke, the unit (21) with the fork members and the secondary gripper is located above the tail end of the wrapping, and finally means being envisaged for ensuring  
5 that this unit is subsequently lowered so that its pair of fork members (221) moves down onto the tail end of the film and bundles it together along its bottom edge (B) which rests on a counter means (24) which is for example fixed, and at the end of this step it being envisaged closing the jaws (321) of the secondary gripper so that the latter retains the tail end of the wrapping.

10 16) Apparatus according to Claim 15, characterized in that the carriage of the wrapping machine which carries the reel (Z) of wrapping film may be provided with means which at least during the final stages of formation of the bottom pocket (S) in the said wrapping reduce substantially and symmetrically the width of the wrapping film.

15 17) Apparatus according to Claim 15, characterized in that a variable positioning means may be slidably mounted on the guide (17) of the telescopic assembly which carries the unit (21) with the bundling fork members (221) and with the secondary gripper (321), the said means normally being in the bottom part of the said guide and, when the latter is raised, being arranged underneath the tail end of the film and by  
20 associated means being raised while the unit (21) is lowered so that bundling of the tail end of the wrapping inside the fork members (221) is performed with a smaller or minimum downward stroke of the said unit (21).

18) Apparatus according to Claim 15, characterized in that the said counter-means (24) against which the bottom edge (B) of the tail end of the wrapping rests during  
25 bundling together in the fork members (221) associated with the secondary gripper (321) may be mounted on raising and lowering means so as to be able to be raised in synchronism with lowering of the said secondary gripper so that bundling together of the tail end of the wrapping in the said fork members (221) is performed with a smaller or minimum downward stroke of the said unit (21).

19) Apparatus according to Claim 14, characterized in that means are envisaged for ensuring that, following closing of the jaws (321) of the secondary gripper, closing, at a short distance from the latter, onto the section of the tail end of film situated between the said secondary gripper and the supply reel (Z), of a primary gripper (22) is activated, the said primary gripper being also mounted for example on the fixed frame (1) and provided with means which normally keep it in an open position where it does not interfere with the wrapping film and which, upon actuation, bring it into a position for closing its jaws, in order to grip the said section of film which will form the front end of the future wrapping performed by the wrapping machine and which, after intervention of the gripper in question, will be separated from the tail end of the wrapping being performed, by the activation of cutting means (23).

20) Apparatus according to Claim 19, characterized in that the primary gripper (22) may be provided with means which, before closing, raise it so as to contribute to bundling together of the tail end of the wrapping and so as to reduce the stroke of the upper unit (21) which carries the pair of fork members (221) for bundling together the film and the secondary gripper (321).

21) Apparatus according to Claim 19, in which the primary gripper (22) comprises a jaw (122) fixed transversely and with a substantially horizontal arrangement underneath the bottom edge (B) of the tail end of the film and comprises a jaw (222) which in the rest position is aligned longitudinally with respect to the fixed jaw, is remote from the latter and with its end consecutive thereto is fixed onto a horizontal and perpendicular rotational shaft (125) which may be pivoted for example by means of a gear wheel (25, 27) actuated by a rectilinear actuator (29) so that the said pivoting jaw (222) can be brought from the said rest position into the active position arranged on top of the fixed jaw, in order to retain the future front end of the wrapping film (Y).

22) Apparatus according to Claim 19, in which the cutting means (23) consist for example of a blade with sawteeth which is directed upwards and is integral with a carriage (31) which slides inside a tubular guide (32) parallel and alongside the fixed jaw (122) of the primary gripper (22), a rectilinear actuator (33) being housed and

hinged with its body inside the said guide, the said actuator moving the said carriage (31) with the saw (23) which projects from the said guide (32) through a longitudinal window (132) and which in the rest position is protected inside a bridge-piece (35), it being envisaged that, after closing of the primary gripper (22), the blade (23) is moved away from the said protection bridge so as to interfere with the section of film which lies between this gripper and the secondary gripper, in order to separate the tail end (X) of the wrapping retained by the said secondary gripper (321), from the front end (Y) of the future wrapping which is retained by the said primary gripper (22).

23) Apparatus according to Claim 22, in which after separation of the tail end (X) of the wrapping in progress, retained by the secondary gripper, from the front end (Y) of the future wrapping, retained by the primary gripper (22), means are envisaged for raising the telescopic assembly with the secondary gripper (321) and then rotating this assembly through ninety degrees about its vertical axis so as to bring the secondary gripper above the pocket of the film (S), after which means are envisaged for lowering the assembly in question, so as to insert the secondary gripper into the said pocket and then open this gripper, so as to leave the tail end of the wrapping (X) inside the pocket (S), there thus being envisaged means which effect raising of the assembly of the secondary gripper and its return into the rest position with movements opposite to those of the active step, and means being envisaged for effecting lowering into the rest position of the counter-rod (4) which formed the pocket so that the latter elastically closes in order to retain the tail end (X), while in synchronized sequence suitable means perform the removal of the load wrapped by the wrapping station.

24) Apparatus according to Claim 23, in which the arm (119) of the slide (19) which carries the unit (21) with the secondary gripper (321) supports a guide or sliding shoe (36) which extends in bridge fashion from the gripper so as to form a protection which, during insertion of this gripper into the said pocket (S) of the wrapping, is directed outwards so as to come into contact with the film which forms the said pocket when the secondary gripper is extracted from the said pocket so as to avoid damaging interference between the gripper and the film.



25) Apparatus according to Claim 19, characterized in that, at the start of each successive working cycle of the wrapping machine, means are envisaged for ensuring that the primary gripper (22) remains temporarily in the active state and the arm of the wrapping machine with the reel (Z) starts to rotate about the load, remaining temporarily in the low position with the said reel and, before the latter performs a complete revolution, means are envisaged for ensuring that the said primary gripper opens and is arranged in the rest position where it does not interfere with the unwrapping path of the film from the reel, and there being envisaged activating means (37) which with an air jet push upwards and against the load the front end of the wrapping film (Y) retained beforehand by the said gripper, so that this front end is overlapped by the first turns of the wrapping film and remains completely incorporated within the said wrapping which in this way is correctly formed also during the initial stages.

26) Apparatus according to Claim 25, characterized in that, in a different embodiment, means may be envisaged for ensuring that, before the start of each working cycle, the primary gripper (22) pivots closed in the direction of the load so as to move the front end of the film towards the load and that the upper jaw of the jaws of the said gripper then rotates through 180° so as to open with respect to the other jaw which remains in its existing position, while in synchronism the said blowing means are activated so as to push the front end of the wrapping against the load so that it is overlapped by the first turns forming the said wrapping.

27) Apparatus according to Claim 25, characterized in that means may be envisaged for ensuring that opening of the primary gripper is activated after the first revolution of the reel (Z) about the load to be wrapped so that the front end of the winding is tucked in between the first and second turn of the said wrapping.